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Consistency of Lubricating Greases and Oils at Low Temperatures

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Presented Before 9th Annual Meeting N. L. G. I.

A knowledge of the properties of lubricating greases and oils at low temperatures is of extreme importance now in view of the demands placed upon lubricants for low temperature operation by the National Defense Program.

It will be noted that the present paper covers not only lubricating greases but also lubricating oils. The usual method of expressing the characteristics of mineral oils at low temperatures is by stating its viscosity at the particular temperature as obtained by extrapolation from viscosities at higher temperatures, for example, 100°F. and 210°F. using the ASTM Chart. While this method is satisfactory in most cases, it is obvious that for high viscosity oils where the extrapolated viscosities may run into several million seconds, the real consistency of the product is in doubt. Also, there is some question as to the meaning of viscosities of oils extrapolated to temperatures below their four points. Under such conditions it is preferable, therefore, to make actual determinations of the properties of the lubricants at the low temperatures involved. However, to do this each particular set of conditions would require a different means of evaluating the low temperature characteristics of lubricating greases and oils, that is, consideration would have to be given to the type of service, speed of the bearing, type of bearing, etc., etc. As an approach to the answer, so-called static torque tests have been devised for greases to be used on anti-friction bearings operating at low temperatures. However, such tests are usually open to the objection that a low torque reading may indicate that a grease channels, that is, that it has gotten very stiff but its texture permits of "channelling through" by the balls rather than that the grease remained soft and plastic enough to offer little resistance to turning. Obviously the interpretation of such readings in terms of low temperature operation is difficult.

A simple method, however, for determining the properties of oils and greases at low temperatures is by the use of the ASTM Penetrometer,[1] the subject of this paper. This equipment is inexpensive and readily available in most petroleum laboratories. Also, ASTM penetrations are very simple to carry out and are capable of reasonable reproducibility. Penetration gives a definite picture of consistency and is a fair relative measure of how hard or how soft materials are at any temperature desired.

Description of Method

In the present paper the range of temperatures used was from − 25°F. to +77°F. (the latter is the standard temperature for taking ASTM penetrations). Lubricating greases of different soap bases containing mineral oils of different viscosities and pours, etc. were tested. The range of mineral oils covered both paraffin and naphthene base, of high and low pour, and of viscosities from about 100 at 100 Saybolt Universal to 200 at 210 Saybolt Universal. In order to assure accuracy and reproducibility of results all of the penetrations were taken in a large cold room maintained at the desired low temperature for several hours, usually overnight, to assure samples being at the desired temperature. Actual determinations were made on the unworked samples at —25° F., —10° F., O° F., +15° F., +32° F., +50° F., and +77° F. Temperatures on the order of —100° F. are to be used in the future with this as well as other devices for measuring static as well as dynamic characteristics of greases and oils at these low temperatures. In the case of torque tests, efforts will be made to overcome channelling.

Experimental Data

A. Mineral Oils

The mineral oils on which low temperature data have been obtained are those commonly used in grease manufacture. Tables I, II, and III cover, respectively, naphthene base mineral oils of approximately 0 Viscosity Index, paraffin base (high pour) mineral oils and paraffin base (low pour) mineral oils showing penetrations taken at 0° F., —10° F., and —25° F. as well as the pour points. In the case of the naphthene base oils as is to be expected, the consistencies become harder with increased viscosities but in the case of the high pour paraffin oils, Table II, at —10° F. the high viscosity oil, 1400/100 Saybolt Universal, +10° F. pour, was actually somewhat softer than the 300/100 viscosity oil although the latter had a somewhat higher pour, 15° F. On the other hand at −25° F. the lower viscosity (300/100 Saybolt Universal) oil was much softer, that is, 163 vs. 94. In the case of the paraffin base mineral oils of low pour (all being —5° F., Table III) the higher viscosity oils gave the harder consistency at both —10° F. and —25° F.

A comparison of naphthene vs. paraffin base mineral oils at —25° F. is given in Table IV in which are also shown the cor-

responding pour points of these oils. For *low viscosity* oils, that is, 100/100° F. Saybolt Universal, it is seen that the naphthenic oil is still fluid, being too soft for an ASTM unworked penetration whereas the high pour (+20° F.) Paraffinic oil was so hard as to correspond to about a No. 5 consistency grease. In the case of the low pour paraffinic oil no data were available for 100/100° F. Saybolt Universal viscosity but for 175/100° F. Saybolt Universal viscosity and —5° F. pour the ASTM penetration was 199, still much harder than the naphthenic oil. This was obviously due to the pour effect since the pour of the naphthenic oil was a —35° F. or below the temperature at which consistencies were taken, whereas in the case of the paraffin oils their pours were much higher than the —25° F. temperature involved. At a viscosity of 300/100° F. Saybolt Universal the naphthenic oil at a —25° F. is still much softer than either the high pour or the low pour paraffinic oil. Here, again, the naphthenic oil has the lowest pour corresponding just to the point where the low temperature consistencies were determined, whereas both paraffinic oils have pours above this temperature. It should be noted that the low pour paraffinic oil is somewhat softer than the high pour paraffinic oil which is in line with their respective pour points. For *high viscosities*, for example, 90/210° F. Saybolt Universal, even the high pour paraffin base oil, is considerably softer than the corresponding viscosity naphthene base oil in spite of the fact that the pour of the naphthene base oil, +15° F., is even slightly higher than the high pour paraffin, +10° F., that is, the 90/210° F. Saybolt Universal naphthene base oil at a —25° F. had a penetration so hard that it would correspond to the brick type of grease whereas the paraffinic oil was softer corresponding to about a No. 6 grease consistency. This is due to the viscosity effect of the naphthenic oil. It is interesting to note that when a paraffinic oil of +10° F. pour point is compared with one of —5° F. the consistency at a —25° F. is softened only from 94 ASTM penetration to 102 ASTM penetration.

It has been assumed in the past that a knowledge of viscosities and pour is an indication of low temperature characteristics of mineral oils but this may not be. For example, in Table V is shown the low temperature penetrations of two oils obtained from the same residuum but employing two methods of processing to give oils of identical viscosities and pours (200/210° F. Saybolt Universal and +15° F. pour). In Method A the penetration at —10° F. was 165 and in Method B much harder, that is, 100. Therefore, the pour point of an oil even with a knowledge of its viscosity is not necessarily a criterion of its consistency, at low temperatures.

B. Lubricating Greases

In Figure 1 are shown four typical line soap greases of varying soap contents using the same naphthene mineral oil (300/100 viscosity Saybolt Universal and —25° F. pour). As is to be expected, there is a gradual lowering of penetration with decreased temperature although the penetration-temperature slope is rather flat. Increases in soap, of course, result in harder products. Table VI shows the actual readings obtained at three temperatures. In Figure 2, four lime soap greases have been chosen of the same penetration at 77° F. but made with different viscosity oils varying from 300 to 2000 at 100° F. Saybolt Universal. The fan-shape of this group of curves shows that increases in the viscosity of the mineral oil ingredient of a grease have a marked hardening effect on the resultant grease at low temperatures. Table VII shows the actual readings obtained at −10° F. There is a hardening of some 50 points at this temperature by increasing the mineral oil viscosity from 300 to 2000.

Figure 3 shows the low temperature characteristics of four soda soap greases of varying soap contents made with the same high viscosity, high pour, paraffin base cylinder stock. It will be noted that these curves in Figure 3 are much steeper than those in Figure 1, inasmuch as in the latter the greases were made with a low viscosity, low pour naphthene mineral oil. Table VIII gives the actual figures obtained at 0° F. expressed in two ways. Since the ASTM unworked penetration was too low at this temperature to obtain accurate readings, a modification of the ASTM Penetrometer was used which consisted merely in adding a weight of 475 grams to the ASTM cone making a total moving weight of 625 grams. The last column of Table VIII shows the different values obtained by this means, i.e. from 92 modified penetration at 7% soap to 52 modified penetration at 30% soap which is not as much hardening as would be expected from the increase in soap content. The effect of the viscosity of the mineral oil on soda soap greases is given in Table IX. The high viscosity, high pour mineral oil gave a much harder product at 0° F. than the low pour, low viscosity mineral oil grease for about the same consistency at 77° F.

A study of greases made with different kinds of soaps is given in Table X. Using the same mineral oil (viscosity 300/100° F. Saybolt Universal and —25° F. pour), three greases were made using soda, lime, and aluminum soap, respectively. For the same penetration at 77° F. the lime and aluminum soap greases seemed to give somewhat softer products than the soda soap grease although the differences are not believed significant.

Some information has also been obtained on liquid greases (lime soap) as shown in Table XI. Since these greases are too soft to obtain penetrations by the ASTM method, a counter balance modification was used.[2] In this method the total moving weight of the ASTM cone and moving parts has been reduced from the standard 150 grams to 25 grams. As is to be expected, the consistency becomes harder with increased soap content but there is an indication that a very small amount of soap, as shown in the 0.5% and 1.5% soap greases, induces a penetration at low temperatures even softer than the mineral oil from which it is prepared.

PRACTICAL APPLICATION

The above information can be applied to the solution of practical problems for obtaining oils of extremely high Viscosity Index when specified. For example, a request was received for a lubricant having the following characteristics:

1. Must not leak at high atmospheric temperatures (125° F.).
2. Must handle in a grease gun at low temperatures of the order of 0° F.

As an example of a satisfactory product from a consistency standpoint the following limits of viscosity were specified:

Viscosity at 210° F. Saybolt Universal = 750.
Viscosity at 100° F. Saybolt Universal = 8,000.
Viscosity at 0° F. Saybolt Universal = 600,000 (extrapolated).
Viscosity Index = 124.4.
Pour, ° F. = 0.

When this problem was assigned, it was necessary to add some 75% of a blown vegetable oil to mineral oil to obtain a product meeting these rather severe specifications for Viscosity Index. This was, of course, a very expensive solution to the problem apart from the fact that the resultant lubricant ultimately proved unsatisfactory due to poor oxidation resistance.

In view of the high viscosities involved it was suggested that instead of using extrapolated viscosities to determine the consistency at the low temperature desired, that is, 0° F., actual penetrations at this temperature be obtained in relation to the higher temperatures at which the product was also to function. Also, instead of using high Viscosity Index oils and adding rather expensive Viscosity Index dopes, it was suggested that perhaps soaps, as used in grease manufacture, which are relatively inexpensive might give products of the desired flat temperature - consistency relationship even with low Viscosity Index naphthene oils, the latter, of course, to be of low pour.

PRIORITY RATING CHART ON OIL INDUSTRY MATERIALS

A CONDENSATION OF ORDER

P-98

	PURPOSE FOR WHICH MATERIAL IS NEEDED	PRIORITY PREFERENCE RATING	PARAGRAPH TO BE CITED IN PURCHASE ORDER	WHERE PURCHASE ORDER IS TO BE SENT	LIMITATIONS
PRODUCING (INCLUDING NATURAL GASOLINE)	Geological or geophysical prospecting	A-1-e	(b) (1) (i)	Washington	To be used directly in search of new pools or extensions
	Research work on production in existing laboratory	A-2	(b) (1) (ii)	Nearest OPC Office	For improving efficiency in producing
	"Wildcatting" — Exploration for new pools — including "slim hole" drilling	A-2	(b) (1) (iii)	Washington	Test to be 2 miles or more from existing production—air line distance; if material can be obtained on A-8, send order for endorsement to nearest OPC office
	Production — Maintenance or repair—operating supplies	A-8	(b) (1) (iv)	*Nearest OPC Office	Does not include items carried as fixed assets unless beyond repair and junked when replaced
	Drilling—except wildcatting —well completion	A-8	(b) (1) (v)	Nearest OPC Office	One oil well to 40 acres—one gas well to 640 acres
	Pumping or other artificial lift	A-8	(b) (1) (v)	*Nearest OPC Office	Equipment for not more than average of one well to 10 acres on lease or one well only on lease of 10 acres or less. Also equipment for wells drilled on 40-acre spacing under M-68
	Oil Treating	A-8	(b) (1) (v)	*Nearest OPC Office	
	Salt water disposal or injection	A-8	(b) (1) (v)	Nearest OPC Office	Does not include artificial lift equipment
	Repressuring — Water flooding, air or gas drive	A-8	(b) (1) (v)	Nearest OPC Office	
	Pressure maintenance or primary gas cycling	A-8	(b) (1) (v)	Nearest OPC Office	Special permission of OPC required
REFINING	Repair after breakdowns	A-1-a	(b) (2) (i)	Washington	Material needed must not be otherwise available
	Provision against breakdowns or plant shutdowns	A-1-c	(b) (2) (ii)	Washington	Not to be added to normal stocks already on hand
	Chemical supplies	A-2	(b) (2) (iii)	Washington	List given in (b) (2) (iii) of P-98
	Supplies for existing research laboratory	A-2	(b) (2) (iv)	Nearest OPC Office	To be used exclusively in improving refinery operations
	Operating supplies (not including chemicals)	A-8	(b) (2) (v)	*Nearest OPC Office	Not including chemical supplies
	Maintenance and repair materials (other than emergency supplies)	A-8	(b) (2) (vi)	*Nearest OPC Office	Not to replace items carried as fixed assets unless replaced item is beyond repair and is scrapped
	Materials for refinery alterations	A-8	(b) (2) (vii)	*Nearest OPC Office	For increase in efficiency; cost not to exceed $1,000
Transportation	Repairs after breakdowns	A-2	(b) (3) (i)	Washington	When material not otherwise available
	Maintenance and repair	A-8	(b) (3) (ii)	*Nearest OPC Office	For normal operations
	Operating supplies	A-8	(b) (3) (iii)	*Nearest OPC Office	
	Alterations	A-8	(b) (3) (iv)	*Nearest OPC Office	Limit $1,000
Marketing	Maintenance or repair	A-10	(b) (4) (i)	*Nearest OPC Office	Not to replace fixed assets unless junked
	Operating supplies	A-10	(b) (4) (ii)	*Nearest OPC Office	Not to expand existing facilities

***Countersignature not required on orders under $500.00 but purchase order must bear endorsement prescribed in P-98.**

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As a standard of comparison penetrations were taken on the approved product at 77° F. and at 0° F. Since this product was too soft at 77° F. for the regular ASTM penetration, use was made of the modified method described above wherein the ASTM cone and moving parts weighing the regulation 150 grams, were reduced by counter balance to 25 grams. By this means the accepted product had the following consistencies:

Penetration at 77° F. ASTM Modified Method — 25 Gram Cone = 366
Penetration at 0° F. ASTM Standard Method — 150 Gram Cone = 302

As shown in Table XII, naphthenic oils of both low and high viscosities as well as a high viscosity, low pour paraffinic oil were used in conjunction with small amounts of soap. It was possible to make a product having better temperature-consistency characteristics than the standard blown vegetable oil-mineral oil product by using only a very small amount of soap, 3%, with a naphthenic oil of 300/100° F. Saybolt Universal viscosity, —25° F. pour and approximately 0 Viscosity Index. Referring to this product B of the table, it is seen that although it is harder than the standard at 77° F., it is softer than the standard at 0° F. When higher viscosity oils were used, whether naphthenic or paraffinic, the consistency-temperature characteristics at low temperatures were not as good as evidenced by products C and D in this table. It is obvious, therefore, that soap acts as a satisfactory "Viscosity Index Dope" in obtaining products of good low temperature characteristics when added to mineral oils and also offers an inexpensive means for doing this.

SUMMARY

The properties of lubricating greases and mineral oils at low temperatures have been studied by means of the ASTM Penetrometer and modifications. Comparing naphthene versus paraffin base mineral oils, in the case of *low viscosities* the pour point seems to be the controlling factor since the naphthenic oils which have lower pours are much softer at low temperatures (e.g. —25° F.) than corresponding viscosity paraffin oils in spite of the much higher Viscosity Index of the latter. Therefore, Viscosity Index is not necessarily a criterion of low temperature consistencies. In the case of *higher viscosities* (e.g. 90/210° F. Saybolt Universal), naphthenic oils are much harder than the corresponding viscosity paraffinic oils at low temperatures even though the pour points may be approximately the same which indicates that the viscosity effect is responsible for the hardening with these oils.

The pour point of an oil is not necessarily the criterion of low temperature consistency since two oils having the same viscosities and same pour points may have entirely different consistencies at low temperatures.

As regards lubricating greases, those made from low viscosity oils show the least change in penetration with reduced temperatures in comparison with the high viscosity oils. With the same ASTM penetration at 77° F. and the same mineral oil, the type of soap does not appear to have a marked effect on the low temperature penetration. In the case of greases semi-fluid at room temperatures there are indications that the addition of small amounts of soap may result in products having consistencies at low temperatures even softer than the mineral oil which was used in making the grease. Lubricating greases offer an inexpensive means of obtaining products of extremely high Viscosity Index or rather flat consistency-temperature characteristics.

ACKNOWLEDGMENT

The writer wishes to acknowledge the assistance of Mr. C. P. Stevens in the performance of the experiments.

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TABLE I

NAPHTHENE BASE MINERAL OILS

Viscosity Say. Univ.	Pour ° F.	Penetration ASTM Unworked 0° F.	—10° F.	—25° F.
100/100° F.	—35	Too Soft	Too Soft	Too Soft
300/100° F.	—25	" "	" "	392
500/100° F.	—20	" "	" "	250
750/100° F.	—10	" "	" "	217
1200/100° F.	+ 5	" "	350	150
2000/100° F.	+15	280	221	33
(90/210° F.)				

TABLE II

PARAFFIN BASE (HIGH POUR) MINERAL OILS

Viscosity Say. Univ. At 100° F.	Pour ° F.	Penetration ASTM Unworked 0° F.	—10° F.	—25° F.
100	20	225	200	122
300	15	Too Soft	246	163
1400 (90/210)	10	Too Soft	288	94

TABLE III

PARAFFIN BASE (LOW POUR) MINERAL OILS

Viscosity Say. Univ. At 100° F.	Pour ° F.	Penetration ASTM Unworked 0° F.	—10° F.	—25° F.
175	—5	Too Soft	Too Soft	199
350	—5	" "	" "	171
500	—5	" "	" "	168
850	—5	" "	370	161
1250 (90/210)	—5	" "	264	102

TABLE IV

NAPHTHENE VS. PARAFFIN MINERAL OILS

	Penetration ASTM Unworked At —25° F. 100/100° F. Say. Univ.	300/100° F. Say. Univ.	90/210° F. Say. Univ.
Naphthenic	Liquid	392	33
Paraffinic, High Pour	122	163	94
Paraffinic, Low Pour	199*	180	102
	Pour, ° F. 100/100° F. Say. Univ.	300/100° F. Say. Univ.	90/210° F. Say. Univ.
Naphthenic	—35	—25	+15
Paraffinic, High Pour	+20	+15	+10
Paraffinic, Low Pour	—5	—5	—5

*Viscosity = 175/100° F. Saybolt Universal.

FIGURE 1

EFFECT OF PER CENT LIME SOAP
MINERAL OIL VISCOSITY SAY. UNIV. = 300/100

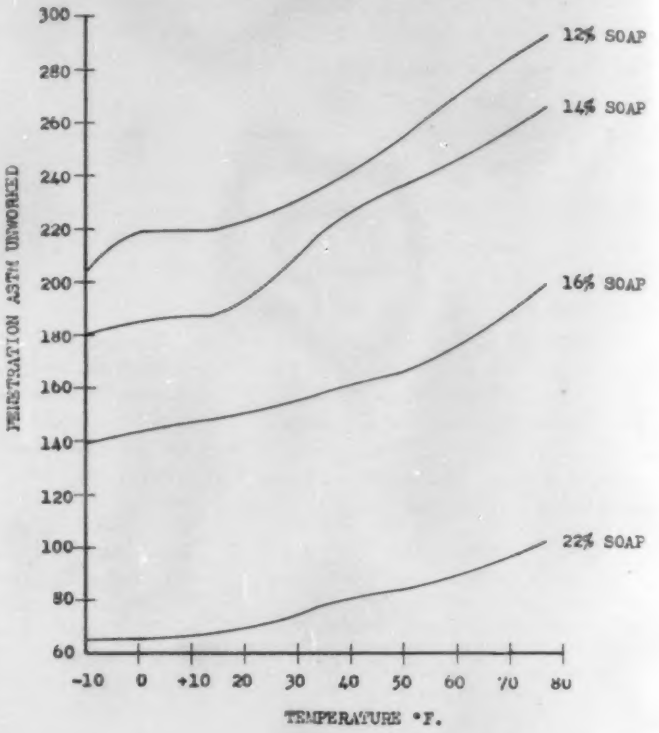

FIGURE 2

EFFECT OF MINERAL OIL VISCOSITY
ON LIME SOAP GREASES

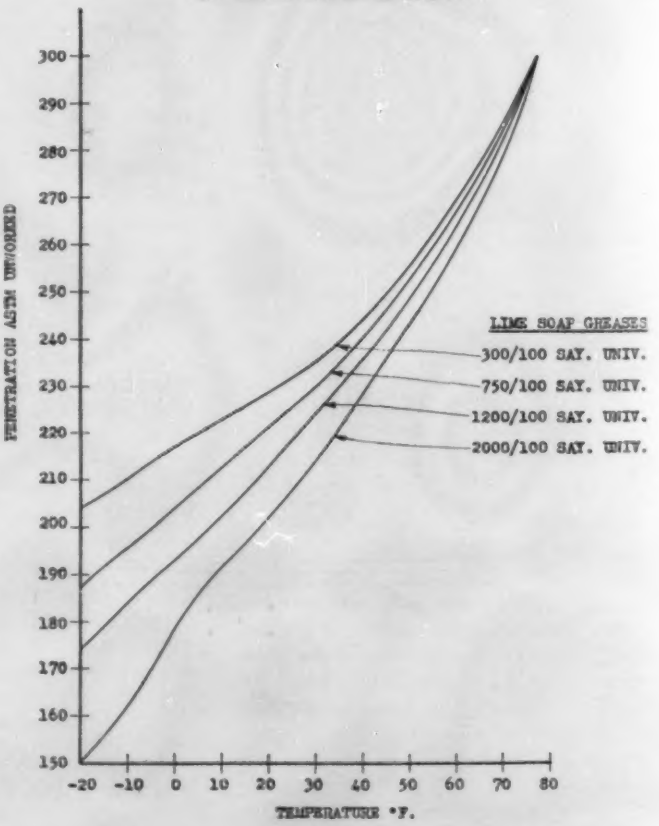

TABLE V

Effect of Method of Processing

Mineral Oils

Method	Viscosity Say. Univ. At 210° F.	Pour ° F.	Penetration ASTM Unworked 15° F.	0° F.	—10° F.
A	200	+15	Too Soft	248	165
B	200	+15	388	131	100

TABLE VI

Lime Soap Greases

Effect of Per Cent Soap

Viscosity of Mineral Oil = 300/100 Say. Univ.

Pour of Mineral Oil = —25° F.

Soap Per Cent	ASTM Penetration Unworked 77° F.	0° F.	—10° F.
12	293	219	204
14	266	185	180
16	199	143	139
22	102	66	....

FIGURE 3

EFFECT OF PER CENT SODA SOAP
MINERAL OIL VISCOSITY =175/210 SAY. UNIV.
MINERAL OIL POUR = 90°F.

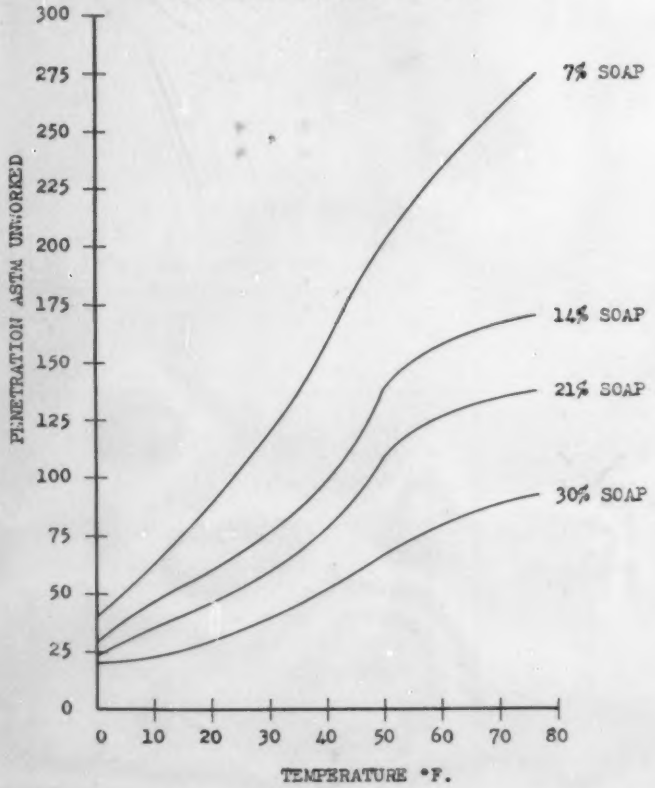

TABLE VII

Lime Soap Greases

Effect of Viscosity of the Oil

Viscosity Say. Univ.	Pour ° F.	ASTM Penetrations Unworked 77° F.	—10° F.
300/100	—25	300	210
750/100	—10	300	196
1200/100	+5	300	184
2000/100	+15	300	161

TABLE VIII

Soda Soap Greases

Effect of Per Cent Soap

Viscosity of Mineral Oil = 175/210 Say. Univ.

Pour of Mineral Oil = 90° F.

Soap Per Cent	ASTM Penetration Unworked 77° F.	0° F.	ASTM Penetration +475 GMS. Unworked 0° F.
7	275	40	92
14	170	29	75
21	137	24	68
30	92	20	52

TABLE IX

Soda Soap Greases

Effect of Mineral Oil Viscosity

Mineral Oil Viscosity Say. Univ.	Pour ° F.	Soap	ASTM Penetration Unworked 77° F.	0° F.
300/100	—25	15	268	168
175/210	90	12	275	40

TABLE X

EFFECT OF KIND OF SOAP

MINERAL OIL VISC./100° F. SAY. UNIV. = 300

POUR = —25° F.

Soap	ASTM Penetration Unworked 77° F.	0° F.	—10° F.
Soda	268	168	160
Lime	266	185	180
Aluminum	269	190	180

TABLE XI

LIQUID GREASES (LIME SOAP)

MINERAL OIL VISCOSITY/100° F. SAY. UNIV. = 300

POUR = —25° F.

Soap Per Cent	Penetration Counter Balance Cone Method 25 GM. Net Moving Weight 0° F.	—25° F.
0.5	Too Soft	Too Soft
1.5	360	312
4.0	298	Too Hard
Mineral Oil	Too Soft	232

TABLE XII

EFFECT OF SOAP ON MINERAL OILS OF DIFFERENT VISCOSITY

	Soap Per Cent	ASTM Penetration 77° F. 25 GM. Cone	0° F 150 GM. Cone Standard
A. Standard	None	366	382
B. Naphthenic Mineral Oil 300/100 Viscosity Say. Univ. & —25° F. Pour	3	342	406
C. Naphthenic Mineral Oil 90/210 Viscosity Say. Univ. & +15° F. Pour	1.5	392	344
D. Paraffinic (Low Pour) Mineral Oil 90/210 Viscosity Say. Univ. & —5° F. Pour	1.9	360	351

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Grease Manufacturers Classed as "Refiner" Under P-98

Following is reproduction in part of a letter received from our Treasurer, Mr. E. V. Moncrieff, who has been in close contact with Washington on this subject.

RE: P-98

"I am attaching a copy of a letter which is more or less self-explanatory and I know is a very welcome letter certainly on the part of our independent grease manufacturers.

"You will note that we have definitely been placed under the refiner section which gives us a priority rating of A-8 or better, sometimes as high as A-1-2.

"Now, what they mean by the second sentence in Paragraph 2 is that we are only entitled to the priority rating under the Marketing Section for any equipment which we use in the distribution of our products, even though we do not operate service stations, etc. What they mean by that is that some of us may go to the point of either buying, loaning or leasing pumps, highboys, etc., or in the case of some concerns he pointed out they even sell equipment for the use of their products in industrial plants, which you know is part and parcel of one of our members under a brand new set-up. In other words, we are perfectly safe in using the priorities under P-98 if we are operating or selling our goods F.O.B. our plants, F.O.B. our plants freight allowed or freight prepaid, which means that as far as we are concerned we are through, even though at times we do absorb the freight, but we do not extend ourselves into the marketing situation. If we do we are not entitled to the refinery priorities. I think the sending out of this information is very important to our members."

Following is reproduced, in part, a letter to Mr. Moncrieff from United States Department of the Interior, Office of Petroleum Coordinator for National Defense, Washington, D. C.

My dear Mr. Moncrieff:

Your letter of January 19 raised certain points upon which I had to consult members of several Divisions in this Office and I sincerely regret the ensuing delay in my reply to your very helpful letter.

The Legal and Refining Divisions are agreed that we can concur in your interpretation that you are processing oil and we are prepared to recommend priorities under P-98 for blending and compounding plants as being in the same category as refiners. I believe that the distribution of your products will properly be considered under Class 4—"Marketing"—even though you do not operate service stations or bulk outlets.

I trust that this interpretation will prove satisfactory and useful to you, your company and others similarly located.

I want to thank you once more for your letter and I appreciate very much your assistance in helping us establish a classification for the grease compounders.

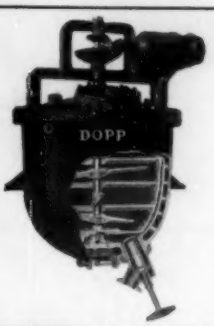
Sincerely yours,

J. ELMER THOMAS (Signed)
Special Asst. to the Deputy Petroleum Coordinator.

Under date of January 16th, the Office of the Petroleum Coordinator interprets Paragraph A-4 "Refining" as the operation of a plant or plants other than those specified in Paragraph A-3, which means "Production" covering the discovery, development and depletion of Petroleum Pools. He further believes that any grease manufacturing plant processing oil, and this does not mean blending or compounding either finished or unfinished, is classified as a refiner; otherwise it may be covered by other divisions of the order.

To further interpret this, I believe that any member of our Institute actually running a grease manufacturing plant in which he is making products of an entirely different composition than the simple blending of two or three oils, would be classified as a refiner.

The attention of our members should be called to Section (b) (2), which outlines the different priority ratings given to concerns coming under the heading of "Refining." These priorities range from A-1-a to A-8, depending on the necessity and use of such materials or operating supplies required. It is suggested that each member obtain a copy of the full text, as there are certain restrictions in the use of ratings and in the application of preference ratings with which each member should be fully acquainted before using any of the ratings given you herewith.



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Counter-Signature Rules Eased by P-98 Amendment

In Amendment No. 1 to Preference Rating Order P-98, War Production Board ruled last week that counter-signatures of field representatives of Office of Petroleum Co-ordinator will not be required on orders for repair, maintenance and operating supplies with a rating of A-8 or lower and valued at less than $500. Amendment was effective Feb. 20.

Counter-signatures are still required, however, for orders of more than $500 or for materials used for new facilities. Amendment stipulated that specific permission must be obtained from OPC to use a rating of higher than A-2 unless material is to be used for research or laboratory purposes.

Text of amendment follows:

TITLE 32—NATIONAL DEFENSE

CHAPTER IX—WAR PRODUCTION BOARD

Subchapter B—DIVISION OF INDUSTRY OPERATIONS

Part 1041

PRODUCTION, REFINING, TRANSPORTATION, AND MARKETING OF PETROLEUM

AMENDMENT NO. 1 TO PREFERENCE RATING ORDER NO. P-98

(a) Section 1041.1 (Preference Rating Order No. P-98, paragraph (e) (2) is hereby amended to read as follows:

(2) In addition to the requirements of paragraph (e) (1), the Operator, (but not a Supplier) in order to apply any of the preference ratings of A-2 or higher assigned by paragraph (b) of this Order, other than ratings assigned by paragraphs (b) (1) (ii) and (b) (2) (iv) hereof, must communicate with the Office of Petroleum Coordinator, Washington, D. C., Ref: P-98, supplying in detail the following information:

(i) date of actual breakdown or suspension of operations (if applicable);

(ii) The equipment to be repaired and its operating importance (if applicable);

(iii) the Material and quantity thereof necessary to effectuate the Repair or to initiate or maintain operations;

(iv) the supply of the necessary Material which the Operator has on hand or available; and

(v) the names and addresses of Suppliers from whom the Material is to be obtained and the earliest delivery dates assured by any such Supplier for delivery of the minimum necessary quantity of Material.

The Director of Industry Operations will notify the Operator whether, and to what extent, the application is approved. A copy of such notification shall be furnished by the Operator to any Supplier to evidence the proper rating granted pursuant to the provisions of this Order.

(b) Section 1041.1 (Preference Rating Order No. P-98, paragraph (e) (3) is hereby amended to read as follows:

(3) In addition to the requirements of paragraph (e) (1), the Operator (but not a Supplier) in order to apply any preference ratings, other than those of A-2 or higher assigned by paragraph (b) of this Order, must obtain the countersignature of the Director in Charge of the nearest District Office of the Office of Petroleum Coordinator upon the purchase order which such Supplier has endorsed and signed pursuant to paragraphs (e) (1); unless,

(i) any completely fabricated, individual item to which a preference rating is to be applied has a cost to the Operator of $500 or less; and

(ii) the rating which is to be applied in obtaining delivery of such an item is assigned by paragraphs (b) (1) (iv); (b) (2) (v), (vi) or (vii); (b) (3) (ii), (iii) (iv); or (b) (4) (i) or (ii).

(c) This amendment shall take effect immediately.

Issued this 20th day of February, 1942.

J. S. Knowlson
Director of Industry Operations

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